Experimental data on growth rates of Pleurochrysis carterae analyzed at Bigelow Laboratory from 2013. (OA Copes Coccoliths project)

Website: https://www.bco-dmo.org/dataset/660050
Data Type: experimental
Version: 1
Version Date: 2016-09-28

Project
» Effects of ocean acidification on Emiliania huxleyi and Calanus finmarchicus; insights into the oceanic alkalinity and biological carbon pumps (OA_Copes_Coccoliths)

Program
» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

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Abstract
Experimental data on growth rates of Pleurochrysis carterae analyzed at Bigelow Laboratory from 2013. (OA Copes Coccoliths project)

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Coverage

Temporal Extent: 2013 - 2013

Dataset Description

Experimental results describing the growth rate of *Pleurochrysis carterae* (NCMA strain 645). It was isolated from 41.525 degrees North, 70.6736 degrees West (Woods Hole, Massachusetts USA), but has been maintained in culture since 1958.

Methods & Sampling

Cultures: *Pleurochrysis carterae* cultures were maintained in exponential growth phase under axenic

conditions in semi-continuous batch culture using L1-Si media prepared on 0.2 um-filtered, UV-sterilized, autoclaved seawater. Cultures were acclimated to one of three pCO2 treatments for > 9 generations before experiments were performed. Cultures were maintained in an incubator at 16.5 +/- 0.5 degrees C and 470 umol photons/m-2/s PAR on a 14-10 light-dark cycle.

pCO2 Treatments: Carbonate chemistry was manipulated by bubbling cultures and prepared media with 500 mL/min with 0.2 um-filtered 280, 380, or 750 ppm pCO2 air. The pCO2 levels of the treatment air were established using two mass flow controllers (Aalborg, Orangeburg, NY, USA) for each treatment to precisely mix in-house compressed air and pure CO2 (Maine Oxy, Auburn, ME, USA). The in-house compressed air was stripped of CO2 to less than 10 ppm CO2 using a Puregas VCD CO2 Adsorber (Puregas, LLC, Broomfield, CO, USA). The pCO2 of the gas mixtures was stable to +/- 8 ppm. pCO2 values of the cultures may be different than the target levels due to biological activity.

Growth rate measurements: At the same time each day, the cell density of each pCO2 treatment culture was measured in order to calculate the growth rate. The data analyzed represent three consecutive growth cycles.

Cell density: Culture density was measured using a Moxi Z mini automated cell counter (ORFLO Technologies, Ketchum, ID, USA), which has a coefficient of variation of 4%.

Data Processing Description

Growth Rate: Growth rate (u) with units d-1 (per day) was calculated using the Excel function LINEST, which calculates the statistics for a line by using the 'least squares' method to calculate a straight line that best fits the data.

The equation for the line is: y = mx + b.

The syntax is: LINEST(known_y's, [known_x's], [const], [stats])

In this case, the 'known_y's' were the ln(cell density); the 'known_x's' were the days of the growth cycle; [const] was set to 'TRUE' which calculates the intercept (b) instead of forcing it to zero; and [stats] was set to 'TRUE' in order to return the regression statistics of the line.

The slope of the line represents the growth rate for the given growth cycle and is analogous to using the standard growth rate equation, except that it incorporates all data points during the growth cycle, not simply the first (0) and last (n) data points.

DMO notes:
- added underscores and removed spaces and units from column names
- changed column names to comply with BCO-DMO standards.
- replaced all "na" with "nd"

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Data Files

File	
growth_rate.csv	(Comma Separated Values (.csv), 1.33 KB) MD5:4b18c9e6d8b5ef8a5381c1aea1381fc3
Primary data file for dataset ID 660050	

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Parameters

Parameter	Description	Units
pCO2_treatment	The independent variable; one of three pCO2 levels (280 ppm, 380 ppm, or 750 ppm). These treatment levels are nominal values as they represent the target pCO2 for each treatment.	ppm
day	The day the measurement was taken (since cultures were started).	unitless
growth_cycle	These data come from three consecutive growth cycles.	unitless
cell_density	Cell density of the culture as measured by the Moxi Z Automated Cell Counter.	cell per milliliter cells/mL
ln_cellDensity	The natural log of the cell density.	ln(cells/mL)
linest_slope	The slope resulting from the excel function LINEST which calculates the statistics for a line by using the 'least squares' method to calculate a straight line that best fits the data. One line is calculated for each growth cycle and the slope represents the growth rate of the algae during that growth cycle. In this case the line was calculated from ln(cell density) and day.	(ln(cells/mL))/day
linest_intercept	The intercept resulting from the excel function LINEST which calculates the statistics for a line by using the 'least squares' method to calculate a straight line that best fits the data. One line is calculated for each growth cycle.	unitless
growthRate	The growth rate for the given growth cycle. This is the slope of the line fit to the ln(cell density) and day data. One growth rate is calculated for each growth cycle.	u/day
mean_growthRate	The average growth rate from the three growth cycles.	u/day
stdev_growthRate	The standard deviation of the growth rates from the three growth cycles.	day-1

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Instruments

Dataset-specific Instrument Name	Moxi Z Automated Cell Counter
Generic Instrument Name	Automated Cell Counter
Dataset-specific Description	Measures culture density
Generic Instrument Description	An instrument that determines the numbers, types or viability of cells present in a sample.

Dataset-specific Instrument Name	Puregas VCD CO2 Adsorber
Generic Instrument Name	CO2 Adsorber
Dataset-specific Description	Instrument stripped compressed air of CO2
Generic Instrument Description	CO2 Adsorber - an instrument designed to remove CO2 and moisture from compressed air.

Dataset-specific Instrument Name	Aalborg Mass Flow Controller
Generic Instrument Name	Mass Flow Controller
Dataset-specific Description	Indicate and control set flow rates of gases. Manufactured in Orangeburg, NY USA.
Generic Instrument Description	Mass Flow Controller (MFC) - A device used to measure and control the flow of fluids and gases

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Deployments

Balch_2013

Website	https://www.bco-dmo.org/deployment/660148
Platform	lab Bigelow
Start Date	2013-07-07
Description	Laboratory located at Bigelow Laboratory for Ocean Sciences

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Project Information

Effects of ocean acidification on Emiliania huxleyi and Calanus finmarchicus; insights into the oceanic alkalinity and biological carbon pumps (OA_Copes_Coccoliths)

Coverage: Laboratory experiments; East Boothbay, Maine

(Extracted from the NSF award abstract)

Ocean acidification is one of the most pressing marine science issues of our time, with potential biological impacts spanning all marine phyla and potential societal impacts affecting man's relationship to the sea. Rising levels of atmospheric pCO2 are increasing the acidity of the world oceans. It is generally held that average surface ocean pH has already declined by 0.1 pH units relative to the pre-industrial level (Orr et al., 2005), and is projected to decrease 0.3 to 0.46 units by the end of this century, depending on CO2 emission scenarios (Caldeira and Wickett, 2005). The overall goal of this research is to parameterize how changes in pCO2 levels could alter the biological and alkalinity pumps of the world ocean. Specifically, the direct and indirect effects of ocean acidification will be examined within a simple, controlled predator/prey system containing a single prey phytoplankton species (the coccolithophore, Emiliania huxleyi) and a single predator (the oceanic metazoan grazer, Calanus finmarchicus). The experiments are designed to elucidate both direct effects (i.e. effects of ocean acidification on the individual organisms only) and interactive effects (i.e. effects on the combined predator/prey system). Interactive experiments with phytoplankton prey and zooplankton predator are a critical starting point for predicting the overall impact of ocean acidification in marine ecosystems. To meet these goals, a state-of-the-art facility will be constructed with growth chambers that are calibrated and have

highly-controlled pH and alkalinity levels. The strength of this approach lies in meticulous calibration and redundant measurements that will be made to ensure that conditions within the chambers are well described and tightly monitored for DIC levels. Growth and calcification rates in coccolithophores and the developmental rates, morphological and behavioral effects on copepods will be measured. The PIC and POC in the algae and the excreted fecal pellets will be monitored for changes in the PIC/POC ratio, a key parameter for modeling feedback mechanisms for rising pCO2 levels. In addition, 14C experiments are planned to measure calcification rates in coccolithophores and dissolution rates as a result of grazing. These key experiments will verify closure in the mass balance of PIC, allowing the determination of actual dissolution rates of PIC within the guts of copepod grazers.

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Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

Solicitations issued under this program:
NSF 10-530, FY 2010-FY2011
NSF 12-500, FY 2012
NSF 12-600, FY 2013
NSF 13-586, FY 2014
NSF 13-586 was the final solicitation that will be released for this program.

PI Meetings:
1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)
2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC)
3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative)

NSF media releases for the Ocean Acidification Program:

Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification

Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?

Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF)

Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF)

Press Release 13-102 World Oceans Month Brings Mixed News for Oysters

Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater Springs Show

How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF)

Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants

Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF)

Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF)

Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1220068

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